Answer on Question #58099-Physics-Other

14 A force of $2\vec{i}+7\vec{j}$ N acts on a body of mass 5kg for 10 seconds. The body was initially moving with constant velocity of $\vec{i}-2\vec{j}$ m/s. Find the final velocity of the body in m/s, in vector form.

$5\vec{i}+12\vec{j}$

$12\vec{i}-5\vec{j}$

$10\vec{i}-7\vec{j}$

$7\vec{i}+10\vec{j}$

Solution

The acceleration vector is

$$\vec{a}=\frac{\vec{F}}{m}=\frac{(2\vec{\imath}+7\vec{\jmath})}{5}\frac{m}{s^2}.$$

The final velocity of the body is

$$\overrightarrow{v_f}=\overrightarrow{v_i}+\vec{a}t=\vec{\imath}-2\vec{\jmath}+\left(\frac{(2\vec{\imath}+7\vec{\jmath})}{5}\right)10=(5\vec{\imath}+12\vec{\jmath})\frac{\mathrm{m}}{\mathrm{s}}.$$

Answer: $5\vec{i}+12\vec{j}$.

15 The exhaust gas of a rocket is expelled at the rate of 1300 kg/s, at the velocity of 50 000 m/s. Find the thrust on the rocket in newtons

6.5×107

3.5×107

7.6×107

5.7×107

Solution

The thrust on the rocket is

$$F=\frac{dm}{dt}v=1300\frac{\mathrm{kg}}{\mathrm{s}}\cdot 50\,000\frac{\mathrm{m}}{\mathrm{s}}=6.5\cdot 10^7 N.$$

Answer: 6.5×107.

16 Sand drops at the rate of 2000 kg/min. from the bottom of a hopper onto a belt conveyor moving horizontally at 250 m/min. Determine the force needed to drive the conveyor, neglecting friction.

500 N

800 N

139 N

152 N

Solution

$$F = \frac{dm}{dt}v = 2000\,\frac{\text{kg}}{\text{min}}\frac{\text{min}}{60\text{ s}} \cdot 250\,\frac{\text{m}}{\text{min}}\frac{\text{min}}{60\text{ s}} = 139\ N.$$

Answer: 139 N.